

The DRIs for Carbohydrates and Fiber

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What were the major recommendations (for carbohydrates)

- The establishment of an RDA for carbohydrate
 - A recommendation on “added sugar” consumption
 - The establishment of an acceptable macronutrient distribution range for carbohydrate
 - No recommendation for a UL based on glycemic index or glycemic load
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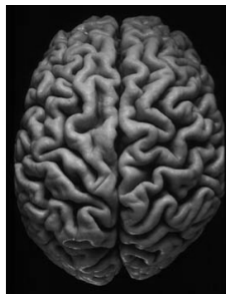
What were the major findings (for fiber)

- The establishment of a definition of fiber.
- The establishment for an AI for fiber.
- The decision to not recommend a UL for total fiber.



The establishment of an RDA for carbohydrate

- RDA is 130 g carbohydrate/day, 1+ Y
 - ↓ infants
 - ↑ pregnant, lactating
- Based on the amount of glucose needed by the brain
- Based on studies in which glucose use by the brain was determined by A-V difference across the brain in humans

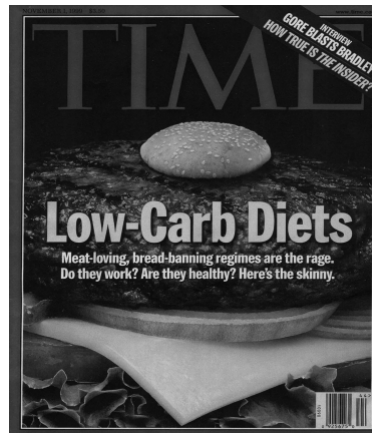


Implications: The RDA is low in terms of actual intake.

- The % of Kcals for a 2000 Kcal diet is only about 25%
 - It is lower than the acceptable macronutrient distribution range for carbohydrates which is set at 45-65% of total Kcals
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Implications: Individuals on very low carbohydrate diets are not meeting the RDA for carbohydrate.

- Low carbohydrate diets
 - Recommend <20 g for 1st two weeks
 - Probably not over 40 g to stay in ketosis



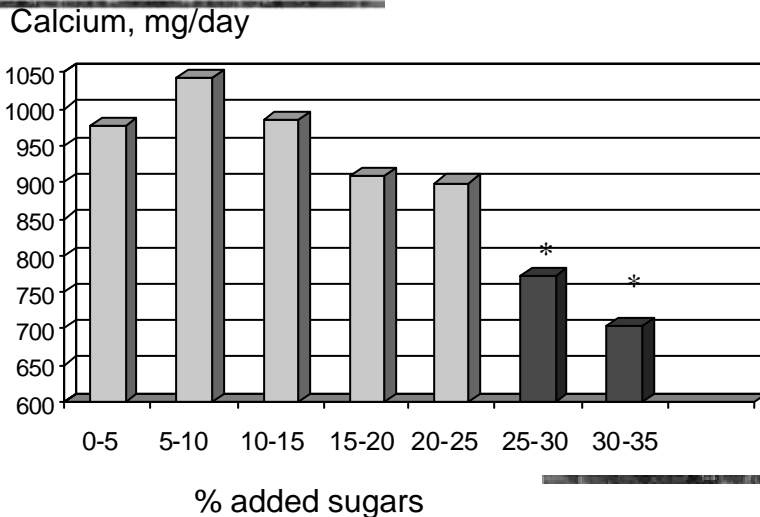
Acceptable Macronutrient Distribution Ranges

- Carbohydrates
 - 45-65% of Kcals
 - Lipids
 - 20-35% of Kcals
 - Protein
 - 10-35% of Kcals
 - Lower than 45%
 - Difficult to meet AI for total fiber
 - Fat may be too high, → obesity
 - Higher than 65%
 - May lead to hypertriglyceridemia
 - Fat or protein may be too low
-

Recommendation on “added sugar” consumption

- Added sugars
 - Sugars and syrups that are added to foods during processing or preparation.
 - Major sources include soft drinks, cakes, cookies, pies, fruitades, fruit punch, dairy desserts, and candy.
 - The recommendation for “Added sugars” is that they not be more than 25% of total Kcals
 - Based on added sugar intake data combined with nutrient intake data
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Calcium intake in children 4-8 Y as a function of added sugar intake



Implications of the “added sugar” recommendation

- “Added sugars on food labels”?
- Use of other sweeteners that wouldn’t be listed as “added sugars”?
- Fortification of foods with “added sugars” to make them more nutrient dense?
- Recommendation on “added fats”?

Glycemic index

- Glycemic Index (GI)=
 - A classification to quantify the relative blood glucose response to carbohydrate containing foods.
 - Glycemic index is calculated by:
 - Providing a set amount of carbohydrate (e.g. 50 g) and calculating the increase in blood glucose for 2-h post-ingestion. This is compared to a reference food (white bread or glucose) tested in the same person.
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Glycemic index of certain foods

Food	GI
■ Carrots	1.31
■ Potato	1.21
■ White bread	1.00
■ Sucrose	.92
■ Cheese pizza	.86
■ Apple	.52
■ Fructose	.32



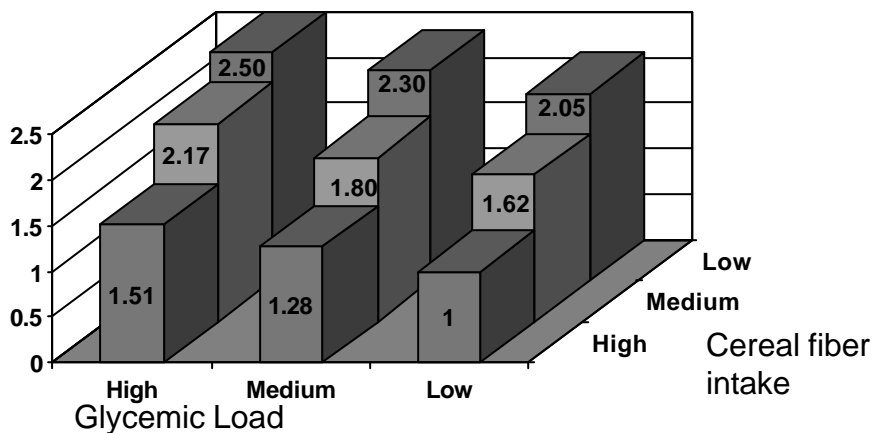
Glycemic load of certain foods

Food	GI	Carbs (g)	GL
■ Carrots	1.31	8	10
■ Potato	1.21	37	45
■ White bread	1.00	24	24



Glycemic Load = Glycemic index
X g of carbohydrate in a serving
of the food

Relative risk of type 2 diabetes



From Salmeron et al. JAMA, 1997

Conclusion on glycemic index/ glycemic load

- A UL based on GI is not made, primarily because the critical mass of evidence necessary for recommending substantial dietary change is not available.
- However, the principle of slowing carbohydrate absorption...is a potentially important principle. Further research in this area is needed.

Food (one serving)	Carbohydrate content (in grams)	Glycemic Index* (percent expressed as decimal)	Glycemic Load (rounded to nearest tenth)
Potato (1 baked)	37	1.21	45
Carrots (½ cup cooked)	8	1.31	10
Lentils (½ cup cooked)	20	0.41	8
Dry beans (½ cup cooked)	27	0.60	16
White rice (½ cup cooked)	35	0.81	28
Wild rice (½ cup cooked)	18	0.78	14
White bread (2 slices)	24	1.00	22
Whole grain bread (2 slices)	24	0.64	15
Pasta (1 cup cooked)	40	0.71	28
Cheerios (1 cup)	22	1.06	23
All-Bran (1 cup)	24	0.60	14
Grape-Nuts (½ cup)	47	0.96	45
Corn flakes (1 cup)	26	1.19	31
Corn chips (1 oz)	15	1.05	16
Popcorn (air-popped, 1 cup)	5	0.79	4

* Standard reference for this table is white bread.
(Carbohydrate content and GI values derived from various sources, including the Division of Preventive Medicine, Brigham and Women's Hospital, Harvard Medical School; "International Tables of Glycemic Index," *American Journal of Clinical Nutrition* (1995); Vol. 62, 871S-93S; and *The Complete Book of Food Counts*, 5th Edition (Dell, 2000), by Corinne T. Netzer.)

Implications for glycemic index/load

- Because of the emerging science in this area, this is something to consider.
- The issue of “types” of carbohydrates, or characterizing their glycemic potential is of interest.

What were the major findings (for fiber)

- The establishment of a definition of fiber.
- The establishment for an AI for fiber.
- The decision to not recommend a UL for total fiber.



Status of the definition of fiber in the US

- In the US, there is no formal definition
 - The Nutrition Labeling and Education Act (1990) Required Dietary Fiber to be on the nutrition label
 - Dietary Fiber defined by a number of analytical methods

Dietary fiber

Amount Per Serving	
Calories 250	Calories from Fat 110
% Daily Value*	
Total Fat 12g	18%
Saturated Fat 3g	15%
Cholesterol 30mg	10%
Sodium 470mg	20%
Total Carbohydrate 31g	10%
Dietary Fiber 0g	0%
Sugars 5g	
Protein 5g	
Vitamin A	4%
Vitamin C	2%
Calcium	20%
* Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs:	
	Calories: 2,000 2,500
Total Fat	Less than 65g 80g
Sat Fat	Less than 20g 25g
Cholesterol	Less than 300mg 300mg
Sodium	Less than 2,400mg 2,400mg
Total Carbohydrate	300g 375g
Dietary Fiber	25g 30g

Rationale for a definition

- Without a definition
 - Compounds not currently analyzed by accepted AOAC methods but which may have physiological fiber-like benefits cannot be termed “dietary fiber”
 - Compounds that do analyze as “dietary fiber” but for which there are no known beneficial physiological effects can be termed “dietary fiber”
 - With a definition
 - The definition determines the methodology
 - Rather than the methodology determining what fiber is and isn't
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Definitions of Fiber

- *Dietary Fiber* consists of nondigestible carbohydrates and lignin that are intrinsic and intact in plants
- *Functional Fiber* consists of isolated, nondigestible carbohydrates that have beneficial physiological effects in humans

Total Fiber is the sum of *Dietary Fiber* and *Functional Fiber*

Distinguishing characteristics of dietary fiber vs functional fiber

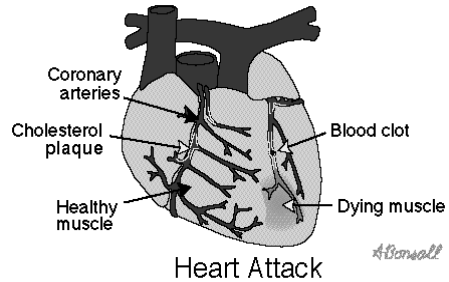
- With Dietary fiber the plant cells and their three-dimensional interrelationship remain largely intact.
 - Only from plants.
 - Dietary fiber sources contain other macronutrients.
 - Functional fiber may be isolated, extracted or synthesized.
 - It can be of animal origin.
 - It has to show a beneficial physiological effect in humans.
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Implications for the definition of fiber

- Food databases including the USDA food database would have to be modified
 - Education would be required to explain “dietary fiber” and “functional fiber”
 - Functional fibers would have to show a health benefit to be on the food label
 - New analytical procedures would be required for fiber analysis
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An Adequate Intake (AI) for total fiber

- Prevention of hyperlipidemia, hypertension, and coronary heart disease
- Gastrointestinal health
 - Ulcers
 - Colon health (laxation, etc.)
- Prevention of cancer
 - Colon
 - Breast
- Glucose tolerance, insulin response, diabetes
- Satiety and weight maintenance



Protecting against heart disease

- 31,208 California Seventh Day Adventists
- If they ate whole wheat compared with white bread
- Have a 50% reduced risk of nonfatal CHD
 - Fraser GE, Sabate J, Beeson WL, Strahan TM. 1992. *Arch Intern Med* 152:1416-24.



Protecting against heart disease

- Iowa Women's Health Study
- If they ate one serving of a whole grain product each day
- CHD risk reduced by ~ 1/3
 - Jacobs DRJ, Meyer KA, Kushi LH, Folsom AR. 1998. *Am J Clin Nutr* 68:248-57.

Iowa Women's Health Study



Prospective fiber and CHD studies

Health Professionals Follow-up Study

- 43,757 US men
- RR= 0.45 for men in highest quintile of fiber intake
- Average intake for best group = 28.9 g/day
 - Rimm EB, Ascherio A, Giovannucci E, Spiegelman D, Stampfer MJ, Willett WC. 1996. *JAMA* 275:447-51.

Nurses' Health Study

- 68,782 US women
- RR= 0.34 for women in highest quintile of fiber intake
- Average intake for best group = 22.9 g/day
 - Wolk A, Manson JE, Stampfer MJ, Colditz GA, Hu FB, speizer FE, Hennekens CH, Willett WC. 1999. *JAMA* 281:1998-2004.

Prospective fiber and CHD studies (Cont.)

Finnish Men Study

- 21,930 Finnish men
 - RR= 0.68 for men in highest quintile of fiber intake
 - Average intake for best group = 34.8 g/day
 - Pietinen P, Rimm EB, Korhonen P, Hartman AM, Willett WC, Albanes D, Virtamo J. *Circulation* 94:2720-2727, 1996.
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The AI for total fiber

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|--|--|
| <ul style="list-style-type: none">■ Men<ul style="list-style-type: none">■ 38 g/day <50 y■ 30 g/day >50 y | <ul style="list-style-type: none">■ Women<ul style="list-style-type: none">■ 25 g/day <50 y■ 21 g/day >50 y |
|--|--|
-
- Based on 14 g fiber/1000 Kcals
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Potential adverse effects of overconsumption of fiber

- Mineral bioavailability
 - Gastrointestinal distress
 - Low energy intake
 - There may be a need for ULs for “functional fibers”, but they would need to be investigated on an individual basis.
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Potential Implications for the AI for total fiber

- Campaigns to increase fiber in the diet as current intake (in the US) is ~ half of the AI.
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What were the major findings (for fiber)

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- There is an AI for fiber.
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